Clinicians and Dyslexia – a computer-based assessment of one of the key cognitive skills involved in drug administration

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Aims. This research investigates the relationship between dyslexia traits and nurse performance on a laboratory task designed to assess one of the key cognitive skills involved in drug administration. The potential moderating role of perceived performance control was also assessed, based on previous work demonstrating the importance of self-belief as a facilitator of vocational success.

Background. Dyslexia within the health care professions has been the subject of wide and emotionally charged debate but has not yet been scientifically examined. Those who fear clinicians with dyslexia do so because of a presumed or potential risk to patient health and safety posed by dyslexia-induced performance error (e.g. problems with drug administration).

Design, Sample and Methods. 46 nurses (40 student nurses and 6 qualified nurses) volunteered to complete a battery of computerised tasks assessing for dyslexia traits (using four accuracy tasks measuring different types of literacy skill), a paired association task designed to measure one of the key cognitive skills involved in drug administration) and a self-report questionnaire (Learning Styles Questionnaire, self-reported reading difficulty and a history of educational support, perceived control over performance). The performance criterion measure was constructed after detailed job analysis (involving analysis of official documentation, in-depth interviews and field observation across a variety of clinical settings) and involved matching drug names to patient names and vice versa.

Results. The results showed that the dyslexia indicators (objective and self-report) were significantly correlated with performance on the paired association task. Contrary to expectation however, the perceived control variable was not associated with performance.

Conclusion. The findings provide tentative support for the idea that some tasks might be problematic for the clinician with dyslexia. Taken in isolation however, it would be inappropriate to conclude that this will necessarily translate into true performance errors without taking into consideration the entire performance context. Suggestions are made for replicating and extending the study to provide a more solid and constructive basis for intervention (e.g. support measures, a built-in checking process).
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With, potentially, as many as one in ten people in Britain diagnosed with dyslexia, the issue of how this might impact on performance at work becoming increasingly of interest (Riddick 1996). This interest has recently also become quite central to considerations of safe clinical practice (Duffin, 2001; Shepherd, 2002; Watkinson, 2002; Wiles, 2001a; 2001b; Wright, 2000).

Dyslexia has been globally described as a ‘reading disorder’ (Davison & Neale, 2001; Reber & Reber, 2001). Some define dyslexia more broadly as a difficulty with language in general, as well as problems with space, time and numbers (Miles & Gilroy, 1996). Whilst the performance implications of dyslexia-induced reading or language difficulties are unclear, folk theories abound of the potential risk to patients posed by clinicians with dyslexia on critical but language sensitive tasks like drug administration. Worries in particular stem from the assumption that the clinician with dyslexia has the “potential to confuse medical terminology or drug names” (Wright, 2000, p39). Indeed, evidence to suggest that student nurses with dyslexia may experience difficulties with “mentally transcribing verbal instructions and accurately reading and interpreting information at speed” (Wright, 2000, p.39) add some weight to these concerns.

Such worries are also fuelled by anecdotal horror stories of near-miss fatalities attributed to dyslexia-induced error (Duffin, 2001; Watkinson, 2002). Paul Lewis of the United Kingdom Central Council for Nursing, Midwifery and Health Visiting (now the Nursing and Midwifery Council) reported on a nurse that he had heard of, who used the colours and sizes of bottles as the basis for matching medication to patients. He argues that this kind of practise is unreliable and thus, puts patients at serious risk.

The possibly large incidence of dyslexia amongst nurses (though no definitive figures are available) (Wright, 2000) combined with the fact that nurses comprise almost 80% of the UK clinician work force (Jasper, 2002), has put this particular clinician group under considerable scrutiny on this issue. However, in rebuttal to the aforementioned fears are positive accounts of the experiences of nursing
students who have successfully fought with their dyslexia to gain their qualifications and who are now competent practitioners. Such accounts maintain that with appropriate support, dyslexia is definitely not a risk, or a hurdle to effective nursing practice (Sheehan & Nganasurian 1994; Shepherd, 2002; Cobley & Parry’s 1997). Some however maintain that it is neither, practical or cost-effective to provide the required level of support ‘in the field’ (Shellenbarger, 1993). Such arguments also continue along the lines that a practising nurse is by definition a professional, fundamental to which is the possession of the ability required for ‘lawful, safe and effective practice without direct supervision’ (clause 6.2 of The Nursing and Midwifery Council Code of Professional Conduct, 2002). On this basis, Wright (2001) reported that as many as 24% of respondents from within the health care profession, considered dyslexia a real practical risk.

To date however there is no scientific evidence to suggest that nurses with dyslexia are not safe to practise (Wright, 2000). Given the particular salience of the drug administration task as one that could be especially dyslexia-sensitive (thereby putting patient safety in jeopardy), this paper reports on a small exploratory study looking systematically at the relationship between dyslexia traits and nurse performance on a laboratory task designed to assess one of the key cognitive skills involved in drug administration. Whilst this task is arguably one that is not ecologically meaningful as a simulation of drug administration in the field, it was specifically designed to investigate the cognitive sensitivity of the task to performance variation in association with dyslexia traits.

Adult Dyslexia and its Performance Implications

There is said to be two broad types of dyslexia induced reading difficulty: developmental dyslexia (with no known neurological basis) and acquired dyslexia (resulting from neurological impairment). Developmental dyslexia is more common than acquired dyslexia and can, itself, also be divided into two forms: dyseidetic (read phonetically, unable to read whole words) and dysphonic (difficulty reading novel or irregular words, reliance on whole word identification (Davison & Neale, 2001). However, individuals will usually present with particular patterns of abilities and difficulties.
Research and advice by authors working within the field of adult dyslexia originates from two different streams, one looking at the primary problems of dyslexia (literacy, spelling, sequencing problems etc.) and the other looking at the secondary problems arising from having to live and cope with dyslexia (Gerber, Ginsberg & Reif, 1992). It is well established that, once diagnosed, the primary problems of dyslexia can be readily overcome with effective training, the use of carefully designed technological aids, and the cultivation of particular types of coping strategies (Fitzgibbon & O’Connor 2002).

Secondary and potentially more complex problems can arise however from frustration with difficulties and in particular, others’ reactions to these (e.g. low self-confidence, performance anxiety, stress induced by perceived stigma). Secondary problems can inhibit performance by inclining people with dyslexia to mask their difficulties and forcing them to evolve various compensatory strategies (e.g. heavier reliance on visual information or cues) that enable them to maintain a ‘cloak of competence’ (Fitzgibbon & O’Connor 2002; McLoughlin, Fitzgibbon & Young 1999; McLoughlin, Leather & Stringer 2002; Osmond, 1993). Some have argued indeed, that the biggest risk to performance is not dyslexia per se, but the high levels of anxiety experienced by people with dyslexia through their reflected appraisal of others’ negative attitudes (Hales, 1995; Osmond, 1993). Ironically then, it may be the masking process and not the difficulties per se, that can pose the most risk to performance.

For people with dyslexia to be successful at work, evidence suggests that they must be open about their difficulties, and self confident enough to be truly open and accountable for their actions (Fitzgibbon & O’Connor, 2002). Unfortunately, confidence might be difficult to sustain in an environment in which one is attributed an irreparable deficiency of competence with potentially dangerous consequences.

Gerber, Ginsberg & Reiff (1992) argue that whilst adults with dyslexia can be highly vocationally successful, this depends fundamentally on their personal attitude, and in particular, how they frame their dyslexia. They say that a high sense of personal control (defined as ‘making conscious decisions
to take charge of life by adapting and shaping oneself”) combined with recognition and acceptance of the difficulty posed by dyslexia (i.e. understanding its implications) implies a greater likelihood of taking positive action to address the difficulty. The latter in particular, presupposes a fundamental shift in the way the dyslexia is framed, moving away from a model of dyslexia as an irreparable deficiency towards one that balances an understanding of dyslexia-induced difficulties in the context of one’s strengths.

Positive reframing of this kind is said to be a facilitator of performance in four main ways:

- increasing persistence,
- fitting oneself into an environment in which success is likely and where strengths can be harnessed,
- the evolution of creative coping strategies, and
- the evolution of supportive social networks.

Consistent with this more positive model of adult dyslexia, Wiles (2001a; 2001b) argues that the person with dyslexia has skills and abilities that make them a valuable asset to nursing (e.g. highly intuitive and insightful, highly aware of the environment, vivid imagination, think and perceive using all the senses, more curious than average). She argues that people with dyslexia are ‘creative masters’, and that it is this creative potential that can and should be more optimally harnessed by the nursing profession, as well as by other professional groups.

**Evidence Based Intervention**

The debate continues over whether nurses with dyslexia and clinicians generally are unsafe to practice, just in need of appropriate support or an unacknowledged performance asset. In a comprehensive review of available research literature, Wright (2000) says that “there is no evidence to suggest that dyslexia should be considered for blanket exclusion within healthcare practice”. However, economic, practical and ethical issues concerning whether the necessary support should or can be provided strongly permeate the debate. In the absence of any systematic evaluation of competence of nurses with dyslexia either in general, or on particular nursing tasks, the debate about whether dyslexia poses a health and safety risk will clearly always remain highly anecdotal and emotive. Moreover, the important question may not be one that asks whether nurses with dyslexia are a ‘risk’ per se, but one that asks more constructively about what the difficulties are, when they might arise and what can be
done about them to ensure that risks are appropriately contained and managed. Whilst performance of any kind will always involve a strong cognitive element (knowledge, skill) (Campbell, 1991), the translation of this ability into practice is a complex multi-dimensional, highly situated consideration. It requires effort and persistence, appropriate personal characteristics and attitude as well as opportunity (including considerations of the environment or context in which performance occurs). Thus to focus solely on cognitive ability (or disability) as a basis for declaring an employee as a ‘risk’ to effective practice would seem (quite apart from the moral and ethical issues raised by these kinds of judgements) theoretically and empirically inappropriate and non-defensible. As Wiles (2001a) put it, “there is much more to nursing that the 3 R’s”.

In the effort to begin this process of identifying specific problems or difficulties as the basis for targeted educational and professional support, the current research investigates the relationship between known dyslexia traits¹ and performance on one particular ‘dyslexia sensitive’ task designed to simulate one of the key cognitive skills involved in drug administration. As Wright (2000, p.40) puts it, we need to know more precisely “what, if any, are the risks, and how can they be minimised?”. It was of particular interest to look at the role played by perceived performance confidence as a potential moderator of the supposed relationship.

**Method**

**Participants**

Forty six volunteer nurses completed the experimental tasks. Forty volunteers were student nurses (from a variety of stages in training) and six were qualified nurses. 40 were females and 6 were men, ranging in age from 18-51 years (average 33 yrs). For 6, English was not their first language but all had spoken English for at least 26 years. Six of the 46 nurses reported reading difficulties (13%), three of whom also reported educational difficulties (0=no difficulties, 1=either educational and/or reading difficulties). 2 nurses (4.3%) reported extreme difficulties with spelling, 20 reported moderate difficulty (43.5%) and 24 reported no difficulty (52.2%).

¹ The aim was not to diagnose dyslexia but to look at variation on established dyslexia traits from low to high in association with performance variation on a clinical task involving dyslexia sensitive cognitive skills.
A multi-formulated computerised pack was compiled to assess: the presence of dyslexia traits (not dyslexia per se) using a standardised test battery, performance on a cognitive task constructed specifically for purposes of the present investigation to assess one of the key skills involved in drug administration (i.e. matching patient names to drug names and vice versa) and perceived performance control. All measures/tasks were thoroughly pilot tested prior to compilation of the final experimental pack.

**Presence of dyslexia traits**

Two well-established standardised measures (Smythe & Everatt, 2002) were used to assess the presence of dyslexia traits: self reported learning difficulties and accuracy tasks. Self-reported learning difficulties were assessed using the 20 item Learning Styles Questionnaire constructed by Smyth & Everatt (2002) for the British Dyslexia Association on the assumption that dyslexia involves a preference for visual over written information and literacy ability. Items 1-14 posed two (either/or) response alternatives whilst items 15-19 offered four. The last question invited a self-reported judgement of reading ability on a three point scale (i.e. good, moderate, and poor). The overall scale is reported to be highly reliable against Kline’s (1993) 0.70 internal consistency confidence criterion and has diagnostic power at a p<.01 level in accounting for variation in independently assessed learning difficulties (Smythe & Everatt, 2002). For the present sample, the alpha coefficient of reliability for the overall scale was 0.63 which may be attributable in part to small sample size (Kline, 1993), coupled with the relative instability of four items (1, 4, 12 and 19) when subjected to item analysis (Smythe & Everatt, 2002). Excluding these items furnished a more satisfactory level of reliability of 0.72. Remaining items were summed and averaged to form a composite variable. It should nonetheless be emphasised that the findings reported here were not affected by item inclusion/exclusion.

The accuracy tasks (Smythe & Everatt, 2002) aimed to measure literacy ability more objectively using four sub-tasks as follows:-
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- 20-item Missing Word task (Spelling in Context) – requiring filling in the missing word (given the first letter) within a sentence (e.g. 'In an emergency d….. 999'). Sentences and words become progressively more complex (e.g. 'O…..is a word that sounds like it sounds’). This task is scored for correct word and spelling.
- Proof reading exercise- Identifying grammatical (e.g. ‘Helen was horrific by finding that her love was shared with many others’) and spelling errors (e.g. ‘forein’) in a narrative passage. This task is scored by counting the number of correctly circled errors (out of 12).
- Letter string exercise 1- Identifying the correctly spelt word from twenty pairs (e.g. feud-fude, thum-thumb).
- Letter string exercise 2- identifying the correctly sounding word (phonological spelling) from each of twenty pairs (e.g. dore-warg, swad-groe) (Zabell & Everatt, 2002).

Performance on the performance (paired association) criterion task
Extensive pilot research involving detailed task analysis (documentation analysis, depth interviews and naturalistic observation) enabled a process model to be constructed simulating drug administration (Figure 1). The intention was to construct an ecologically valid ‘clinical task’ that would enable precise identification and assessment of the cognitive skills involved. A key cognitive skill within the drug administration task was identified as the need to accurately match patient name to medication. To simulate this cognitive ability a paired associated learning task was constructed comprising 20 randomly chosen surnames of the same length (6 letters) that had to be matched to a list of drugs taken from a repeat prescription list at a General Practitioners’ local surgery. Drug names were selected to approximately the same length (8-11 letters) (e.g. Diazepam, Colpermin, Ampicillin). The list was presented for three minutes, allowing 5 seconds for each one. After a distracter task, participants completed a recall task involving either matching name to medication or matching medication to name (to control for order effects). Responses were elicited by presenting six options in each case: correct answer (e.g. Diazepam), two other answers from the original list (e.g. Abacavir, Zopiclone), two phonies (a word that looked like the real world like ‘Diasipam’ and one that sounded like the real word...
like ‘Tridecam’) and an unrelated answer (e.g. Coxitol). The recall task was timed (3 minutes).
Performance on this task constituted the criterion measure (Appendix 1 for details).

Insert Figure 1 here

Perceived Performance Confidence
A self report 30 item questionnaire was constructed to assess the influence of an individual’s perceived control and performance confidence (i.e. self efficacy, conscientiousness, self monitoring) with close reference to the literature pertaining to adult dyslexia in the workplace (Fitzgibbon & O’Connor 2003; Gerber, Ginsberg & Reiff, 1992). Items required reflection on the nursing role in general, as well as on specific nursing tasks, including drug administration. 10 items were negatively worded to interrupt response sets. Sample questions include: ‘I feel confident in my role as nurse’, ‘I am confident doing drugs rounds’, ‘I am often too busy at work to do a task properly’. All responses were invited on a 5-point Likert scale anchored by 1 (strongly agree) through to 5 (strongly disagree). The scale achieved an alpha reliability coefficient of 0.86 suggesting a satisfactory level of internal consistency (Kline, 1993). Items were summed and average to form a composite variable.

Background information
An additional questionnaire was added to collect demographic information (first language, educational qualifications, age, gender) and knowledge of learning difficulties (formal diagnosis, literacy difficulties, educational difficulties).

Materials and Procedure
Participants were each handed a research pack and pencil. The research introduction was read out and participants were invited to ask questions. The eight research tasks and instructions were then read through to ensure a steady pace was kept through completion of each of the tasks. Finally, participants were debriefed and invited to ask questions.
Results

Descriptive Analysis

All data was screened for missing scores, outliers and normality (z scores of skew and kurtosis over 3.29). Missing values were few and appeared random: these were addressed using mean substitution. Table 1 presents the means, standard deviations and percentile scores for each variable. Performance on two of the accuracy tasks (Spelling in Context, Proof Reading) was fairly normally distributed. Thus performance exhibited the complete range of ability from very poor to very good. Performance on the two letter string tasks was heavily skewed in the positive direction, indicating a strong ceiling effect within the present sample on this particular reading competence. In both instances, the majority of the sample scored between 18 and 20 (out of 20), with a lowest score of 15 for one Letter String exercise (identifying correctly spelt word) and of 10 for the other Letter String Exercise (identifying correct sounding word). Since scores on the former task did not discriminate finely across its entire scoring range and did not correlate significantly with the criterion variable, scores from this part of the accuracy testing were excluded from subsequent inferential analysis. Performance on the criterion task was also fairly normally distributed, although the maximum score was only 14 out of 20 suggesting that it was quite a challenging task for the present sample. Fourteen participants scored at or below the 25\textsuperscript{th} percentile (30.4\%) and fourteen scored at or beyond the 75\textsuperscript{th} percentile (30.4\%), with eighteen scoring within the inter quartile range (39.1\%).

Insert Tables 1, 2 and 3 about here

To test the hypothesised relationship between a) dyslexia traits and performance on the criterion task, and b) perceived performance confidence and actual performance on the criterion task, two sets of analyses were undertaken: bivariate correlations and regression analysis. Pearson correlation analysis was also used in part to examine convergent validity across all of the dyslexia indicators. All literacy scores were indeed significantly inter-correlated, confirming that we could viably treat our operational measures as valid indicators of one latent dyslexia trait (Table 2). It is notable also that self-reported learning difficulties
correlated with the more objective dyslexia indicators, providing further evidence for the validity of the
dyslexia indicators overall.

Hypothesis 1 (dyslexia traits and performance) - Pearson correlation analysis yielded significant
correlations for three of the dyslexia indicators (‘Spelling in context’, ‘Spelling and grammar recognition’
and ‘Phonological Spelling Recognition’) against the performance variable (see Table 2). The effect sizes
for these correlations range from 0.45 to 0.54. If these are approximated to 0.5 for purposes of power
calculation, the correlations have a power of approximately 0.95 meaning that the chance of a type 2 error
is low (5%) (Clarke-Carter, 1997). Linear regression analysis showed that when taken alone, performance
on the Missing Word task accounted for 27% of variance in the criterion (F=17.195 p<.000), whilst
performance on the Proof Reading task accounted for 19% of variance (F=11.65 p<.000) and performance
on the Phonological Letter String Task accounted for 27% of variance (F=18.00 p<.000).

Hierarchical Regression Analysis was used to assess more precisely the predictive power of all
dyslexia indicators in accounting for variation in performance on the criterion task. Block 1 entered
self-reported educational and reading difficulty (Dummy Variable), whilst block 2 entered the
objective dyslexia indicators (Missing Word, Proof Reading, Letter String) and Block 3 entered the self-
report Learning Style measure. Block 1 accounted for only 1% of the variance in the criterion variable
(Adjusted $R^2 = 0.10$) and the model was not significant ($F = .450 p<.505$). In other words, self-reported
educational and reading difficulty did not in itself account for variation in performance on the criterion
task. Block 2 produced a significant $R^2$ Change ($F$ Change = 9.042 df=4,45 p<.000) and accounted for 40%
of variance in the criterion (Adjusted $R^2 = .404 F = 6.955 p<.000$). Self-reported educational and/or reading
difficulty appeared to contribute unique variance ($Beta = -.286 t=-1.997 p<.05$) only to the extent that
performance on all three accuracy task were held constant (note that in model 1, this variable was not
significantly associated with the criterion, p<506). In short, none of the accuracy task scores uniquely
accounted for any significant variance over and above self-reported educational/reading difficulty although
the Missing Word scores were significant at p<.08. Adding Block 3 (learning style) did not add any
explanatory power to the accuracy tasks in accounting for variance in the criterion task ($R^2$ Change,
p<.874).
Overall, the results suggest that scores on the objective dyslexia indicators when coupled with self-reported educational and/or reading difficulty (but not self-reported learning style) accounted for significant variation in performance on the criterion task, suggesting a substantial degree of overlap in the cognitive abilities assessed (especially by the Missing Word and Letter String tasks) and the cognitive demands posed by the criterion task. Some support is therefore obtained for hypothesis 1 that dyslexia traits (self-reported educational and reading difficulty coupled with scores obtained from the three dyslexia-sensitive accuracy tasks). In practical terms, 4 in 10 cases of difficulty with the criterion task were predictable from their scores on the objective dyslexia indicators in combination with self-reported educational/reading difficulty. Consistent with this, case wise diagnostics revealed 12 cases in which relatively precise predictions were made by the model (including all six cases of self-reported educational/reading difficulty). A means assessment confirmed that the six participants who reported educational needs and/or reading difficulty consistency scored higher than the other participants on all the dyslexia indicators (Figure 2). These six participants also scored lower on the drug administration task (Figure 3).

_Hypothesis 2 (perceived performance confidence and actual performance on the criterion task)_ - Contrary to expectation, the perceived performance confidence variable was not significantly associated with performance on the drug administration task (Table 3).

**Discussion**

The findings provide some initial evidence for the hypothesized association (Hypothesis 1) between traits, previously established to be strongly associated with dyslexia, and performance on a cognitive task simulating one of the key skills involved in drug administration (i.e. matching patient names to drugs and vice versa). The greater the tendency to dyslexia (assessed using objective measures of literacy ability as well as self-reported reading difficulty and the need for educational support), the poorer the performance on the criterion task. In particular, there was a significant degree of overlap between literacy ability (especially skills pertaining to Spelling in Context, and Phonological Spelling
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Ability) and the cognitive skills demanded of a drug administration task. Whilst self-reported learning style did not explain variance in performance on the criterion task, scores on objective and self-report (direct, indirect) measures of dyslexia significantly converged suggesting that they were valid indicators of dyslexia traits.

However, contrary to expectation (Hypothesis 2), perceived performance confidence did not moderate the empirical association between dyslexia traits and the criterion task (e.g. Gerber, Ginsberg & Reiff 1992; Shepherd, 2002; Wiles, 2001a; 2001b). Presuming that the measure was reliable, the lack of an effect could be due to the highly de-contextualised nature of the criterion task.

It is also important to point out that although the dyslexia indicators did account for significant variance in performance on the drug administration task, substantially more variance (68.3%) remained unexplained by the model. The implications of this are that whilst clinicians with dyslexia may indeed experience some difficulty meeting specific cognitive demands posed by critical tasks such as drug administration (e.g. Watkinson 2002), it is by no means possible to conclude that they are unable to administer drugs competently. Close scrutiny of particular cases demonstrates one case in particular of good performance on the criterion task despite scoring high on dyslexia traits, and conversely, there were many other instances of poor performance on the criterion task despite scoring low on dyslexia traits. Clearly then, there is much more to the criterion task than can be accounted for by dyslexia traits.

Apart from the limited generalisability of the current findings posed by small sample size, the task also assessed literally only the participant’s ability to correctly recall patient’s names and drug names from a given choice. The task did not include the checking process involved after the patient and medication is selected and was also completed under time constraints. Moreover, a bare-bones task of this kind, partials out all of the contextual cues surrounding effective drug administration and does not allow for compensatory strategies to be used in the verification process (McLoughlin, Fitzgibbon & Young 1999: McLoughlin Leather & Stringer 2002; Fitzgibbon & O’Connor 2002; Gerber, Ginsberg & Reiff
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1992). In the raw (or in abstract isolation), performance may indeed be potentially problematic on tasks that pose dyslexia sensitive cognitive demands, but in reality there are likely to be many other factors that moderate the association between dyslexia and clinical performance. For instance, evidence suggests that professionals with dyslexia are often hyper-vigilant, with the potential to make them even more highly conscientious and meticulous practitioners than their peers without dyslexia traits (Wright, 2001). Moreover, a clinician may commit reading errors through many other reasons than dyslexia (e.g. sheer carelessness, stress-induced fatigue, cognitive overload and/or poor motivation).

It might also be argued that the findings are limited by the nature of the sample in that all participants were volunteers and perhaps all slightly anxious about meeting educational demands (mindful of what the research was about). However, there was no evidence that this was the case, as volunteers tended to come ‘as a group’ of friends (and were snowballed accordingly) rather than isolated individuals who had particular cause for concern about their reading ability. Moreover, the distribution of scores was normal on all the dyslexia trait indicators as well as the criterion task suggesting that the sample was not skewed towards those exhibiting performance difficulties. Finally, those people who performed especially poorly on the criterion task also reported educational difficulty in general and reading difficulty in particular, suggesting that the findings could not be explained by some kind of generalised performance anxiety (as opposed to dyslexia traits).

To inform intervention, future research should aim not only to replicate and extend the current study, but to look at other criterion tasks that may pose a similar difficulty to clinicians with dyslexia. For instance, nurses are commonly required to write, manually (computer generated reports are not permissible for litigation purposes), up to 30 or more patient night reports under tight time constraints. In-depth interviews involving nurses with dyslexia currently being undertaken by the authors demonstrate that various self-regulatory (e.g. awareness of strengths and difficulties, constant self-reflection) and compensatory (e.g. seeking external verification, selectivity in tasks, strategic use of particular tools) strategies can be employed to ensure responsible and safe practice. One key
consideration arising from this research is the importance of taking into account the influence of ‘professional judgement’ on performance.

**Conclusion**

The findings provide some initial evidence for an association between dyslexia traits and performance on a cognitive task simulating one of the key skills involved in drug administration (i.e. matching patient names to drugs and vice versa). The greater the tendency to dyslexia (assessed using objective measures of literacy ability as well as self-reported reading difficulty and the need for educational support), the poorer the performance on the criterion task. Scores on objective and self-report (direct, indirect) measures of dyslexia significantly converged suggesting that they were valid indicators of dyslexia traits. Contrary to expectation however, perceived performance control did not moderate the empirical association between dyslexia traits and the criterion task. The findings are interpreted cautiously in the light of small sample size and the highly decontextualised nature of the criterion task. Performance, it is argued, must be looked at in a multi-dimensional way, taking into consideration environmental (e.g. opportunity, contextual infrastructure surrounding a task) and motivational (e.g. persistence, self-awareness and self-monitoring) factors as well as cognitive ability and skill. The findings demonstrate the importance of identifying the practical implications of dyslexia in the context of effective clinician functioning, as a basis for tailoring intervention and providing ‘reasonable adjustment’ to the task environment. Notwithstanding the limitations of the study, at the very least it highlights the importance of forming evidence-based judgements about the performance difficulties clinicians with dyslexia may encounter. Lessons may also be learned for developing ‘check and support’ systems surrounding various clinical practices like drug administration that pre-empt the likelihood of reading type errors in general, caused by many factors, only one of which may be dyslexia.

**Acknowledgements**

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References


Figure 1 Model of the process of drug administration
Figure 2 Mean scores of those reporting Educational Needs and/or Reading Difficulty on the dyslexia indicators

![Dyslexia indicators chart]

Figure 3 Mean Scores of Educational Needs/Reading Difficulty and performance on the drug administration task

![Means chart]
# Table 1 Descriptive Statistics

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<td>22-38</td>
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<td>32</td>
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<td>53.9</td>
<td>-</td>
<td>11.1</td>
<td>30-80</td>
<td>46.8</td>
<td>53</td>
<td>62</td>
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## Table 2 Bivariate Pearson correlations across all independent variables

<table>
<thead>
<tr>
<th></th>
<th>Spelling in context (Missing Words)</th>
<th>Spelling &amp; grammar recognition</th>
<th>Spelling recognition</th>
<th>Phonological spelling recognition</th>
<th>Learning styles</th>
<th>Educational needs or literacy difficulties</th>
<th>Perceived performance confidence</th>
<th>Gender</th>
<th>Language</th>
</tr>
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<tr>
<td><strong>Spelling in context (Missing Words)</strong></td>
<td>r= .56</td>
<td>-.36</td>
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<td>.32</td>
<td>.41</td>
<td>-.03</td>
<td>-.33</td>
<td>-.49</td>
<td></td>
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<td>r= .56</td>
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<td>.57</td>
<td>.45</td>
<td>.50</td>
<td>.20</td>
<td>-.01</td>
<td>-.23</td>
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<td>-.50</td>
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<td>-.23</td>
<td>-.36</td>
<td>-.41</td>
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<td>.14</td>
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<tr>
<td><strong>Letter String II: (Phonological spelling recognition)</strong></td>
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<td>.57</td>
<td>-.39</td>
<td>.46</td>
<td>.45</td>
<td>.09</td>
<td>-.12</td>
<td>-.45</td>
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<tr>
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<td>.45</td>
<td>-.23</td>
<td>.46</td>
<td>.47</td>
<td>-.04</td>
<td>.002</td>
<td>.09</td>
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<tr>
<td><strong>Educational needs or literacy difficulties</strong></td>
<td>r= .41</td>
<td>.50</td>
<td>-.36</td>
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<td>.47</td>
<td>-.03</td>
<td>.04</td>
<td>-.04</td>
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<tr>
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<td>-.41</td>
<td>.09</td>
<td>-.04</td>
<td>-.03</td>
<td>-.01</td>
<td>.13</td>
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<tr>
<td><strong>Gender</strong></td>
<td>r= -.33</td>
<td>-.01</td>
<td>.12</td>
<td>-.12</td>
<td>.002</td>
<td>.04</td>
<td>-.01</td>
<td>.975</td>
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<td>.09</td>
<td>-.04</td>
<td>.13</td>
<td>-.042</td>
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</table>

(significance is 2-tailed)
Table 3 Pearson Bivariate Correlations of dyslexia indicators with performance on the drug administration task

<table>
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<tr>
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<th>Spelling in context (Missing Word)</th>
<th>Spelling and grammar recognition (Proof Reading)</th>
<th>Spelling recognition</th>
<th>Phonological spelling recognition</th>
<th>Learning styles</th>
<th>Educational difficulties or educational needs</th>
<th>Perceived Performance Confidence</th>
<th>Gender</th>
<th>Language</th>
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</thead>
<tbody>
<tr>
<td>Performance on drug administration task</td>
<td>R = .53</td>
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<td>Sig.</td>
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<td>.001</td>
<td>.103</td>
<td>.000</td>
<td>.128</td>
<td>.506</td>
<td>.331</td>
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</table>

(significance is 2-tailed)
Appendix 1 Research Instruments

Drug Chart Exercise Part 1

Task two is a drug chart exercise looking at different patients' medication. The task involves looking at the 20 patient’s names and their corresponding medication. You will have three minutes in which to try and remember them. You will be asked to recall them later.

Do not turn over the page until told to do so.

<table>
<thead>
<tr>
<th>Patient’s Surname</th>
<th>Medication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butcher</td>
<td>Diazepam</td>
</tr>
<tr>
<td>Spragg</td>
<td>Ramipril</td>
</tr>
<tr>
<td>Styche</td>
<td>Heparin</td>
</tr>
<tr>
<td>Ahmed</td>
<td>Pergolide</td>
</tr>
<tr>
<td>Wright</td>
<td>Fluvastatin</td>
</tr>
<tr>
<td>Pelling</td>
<td>Abacavir</td>
</tr>
<tr>
<td>Squires</td>
<td>Amoxapine</td>
</tr>
<tr>
<td>Davies</td>
<td>Lactitol</td>
</tr>
<tr>
<td>Erikson</td>
<td>Capasaicin</td>
</tr>
<tr>
<td>Collins</td>
<td>Fruse deine</td>
</tr>
<tr>
<td>Dixon</td>
<td>Celecoxib</td>
</tr>
<tr>
<td>Ivory</td>
<td>Thyroxine</td>
</tr>
<tr>
<td>Brook</td>
<td>Pimozide</td>
</tr>
<tr>
<td>Zetlein</td>
<td>Movicol</td>
</tr>
<tr>
<td>Holmes</td>
<td>Zopiclone</td>
</tr>
<tr>
<td>Vatcher</td>
<td>Oxazepam</td>
</tr>
<tr>
<td>Gibbons</td>
<td>Colpermin</td>
</tr>
<tr>
<td>Simpson</td>
<td>Ampicillin</td>
</tr>
<tr>
<td>Allen</td>
<td>Cefixime</td>
</tr>
<tr>
<td>Eltoft</td>
<td>Acarbose</td>
</tr>
</tbody>
</table>
**Drug Chart Exercise Part 2**

Task four is the second part of the drug chart exercise you did earlier. In the earlier task you were shown patient’s names and their corresponding medication. You are now asked to recall these. The task is split into two; selecting the medication from the patient’s name, and the patient’s name from the medication. The two sections are on separate pages. Please look at the medication or patients name in the first column and please select the corresponding patient’s name or medication from the six given by circling the correct answer. You will have one and a half minutes for each section. I will indicate when it is time to move on to the next section.

### Matching medication to patient

<table>
<thead>
<tr>
<th></th>
<th>Name</th>
<th>Medication 1</th>
<th>Medication 2</th>
<th>Medication 3</th>
<th>Medication 4</th>
<th>Medication 5</th>
<th>Medication 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wright</td>
<td>Fluvastatin</td>
<td>Thorfastatin</td>
<td>Acarbose</td>
<td>Frusemide</td>
<td>Torvapril</td>
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<tr>
<td>2</td>
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<td>Thruzimine</td>
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<td>Moxetal</td>
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<td>Cutamine</td>
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<tr>
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<td>Aldine</td>
<td>Diazepam</td>
<td>Hetarine</td>
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<td>Acarbose</td>
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<td>Zemstvo</td>
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<td>Colpermine</td>
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<tr>
<td>9</td>
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<td>Brahmin</td>
<td>Fluvastatin</td>
<td>Barcarver</td>
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### Matching Patient to Medication

<table>
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<th>Medication</th>
<th>Patient 1</th>
<th>Patient 2</th>
<th>Patient 3</th>
<th>Patient 4</th>
<th>Patient 5</th>
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<td>Vatcher</td>
<td>Volley</td>
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<tr>
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<td>Davies</td>
<td>Vatcher</td>
<td>Sunny</td>
<td>Valter</td>
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<td></td>
</tr>
<tr>
<td>3</td>
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<td>Pierce</td>
<td>Spragg</td>
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<td>Prager</td>
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